

THE BEST WAY TO GET STARTED WITH TORIC IOLS



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In the beginning, keep it simple.

The best way to get started with toric IOLs is to set yourself up for early success. As with all aspects of refractive cataract surgery, there are many nuances with toric lenses that can be overwhelming initially. By becoming comfortable with the basics of these IOLs, you can gain the confidence needed to tackle increasingly challenging cases. Every toric lens case requires the same basic steps: patient selection, lens selection, marking of the axis, and lens implantation and orientation. Using the guidelines presented in this article is a great way to get started and hopefully help ensure early success for you and your patients.

PATIENT SELECTION

Initially, you should select patients with lower amounts of astigmatism. Think: “Aim small, miss small.” Roughly 3% of astigmatic correction is lost for every 1° of toric misalignment (Table 1).¹ Take, for example, a patient with 4.50 D of cylinder. If the alignment of a fully correcting toric IOL for this patient is off by 10°, the IOL would lose 33% of its effect, leaving the patient with 1.50 D of visually significant astigmatism. If a fully correcting toric IOL is off by the same 10° in a patient with a total of only 1.25 D of astigmatism, the IOL would still lose 33% of its effect; however, it would leave this patient with only 0.41 D of residual astigmatism.

When you begin to incorporate toric IOLs into your practice, it is best to start in patients with regular astigmatism and normal baseline topography. Toric IOLs should be thought of as premium lenses, and they are best suited for premium eyes—those that are healthy from the cornea to the fovea.

Irregular astigmatism due to factors such as ocular surface disease, corneal scars, pterygia, and Salzmann nodules, to

TABLE 1. RESIDUAL CYLINDER ASSOCIATED WITH A FULLY CORRECTING TORIC IOL FOR VARYING DEGREES OF MISALIGNMENT AS A PERCENTAGE OF THE CYLINDER POWER

Degrees of Misalignment (°)	Residual Cylinder of Misaligned Fully Correcting Toric IOL (% of cylinder power)
0	0.00
1	3.49
2	6.98
3	10.47
4	13.95
5	17.43
10	34.73
15	51.76
20	68.40
25	84.52
30	100.00
45	141.42
60	173.21
75	193.19
90	200.00

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name a few, will compromise the efficacy of the toric IOL. In such patients, the corneal irregularity can often be improved medically or surgically. Then, after testing is repeated and the patient's visual status is shown to be stable, the patient may be considered a reasonable candidate for toric IOLs.

LENS SELECTION

In general, you should choose the toric IOL power with the aim of minimizing residual astigmatism. Do not be afraid to flip the axis to with-the-rule (WTR) cylinder in the process (Figure). Traditionally, it was thought that one should never flip a patient's astigmatic axis, regardless of the orientation. However, leaving a patient with a small amount of WTR astigmatism not only gives the patient a slightly increased depth of focus,² but it also helps to neutralize the natural against-the-rule (ATR) cylinder drift that occurs with age.^{3,4} Consequently, many providers treat lower levels of ATR astigmatism and flip the patient's axis to WTR as a result.

To calculate your toric IOL model, power, and axis, we recommend using the Barrett Toric Calculator. There are many options available for toric IOL calculation; however, numerous studies have shown superior astigmatic outcomes with this calculator.^{5,6} Further, the Barrett Toric Calculator can easily be used with any standard IOL, it can be accessed for free from the ASCRS website, and it can be added on as software on certain optical biometry devices to allow automatic, integrated toric IOL calculation.

To get started with toric IOLs, we recommend using monofocal torics. This is advisable because toric multifocal (TMF) IOLs are more sensitive to residual astigmatism than are monofocal lenses, and patients experience a greater loss of visual acuity for a given amount of toric misalignment with a TMF.⁷ The surgeon can be put in a difficult position

when a patient is unhappy with his or her vision with residual astigmatism after TMF implantation. It is challenging in this situation to determine whether such a patient is best suited for further astigmatism correction or for IOL exchange with a monofocal IOL. Therefore, because it is arguably more crucial that astigmatism be fully corrected in a TMF patient, it is recommended to start with monofocal toric IOLs until you become comfortable with the basics of torics.

AXIS MARKING

There are many methods of marking the axis on the eye.⁸ The cheapest and easiest way is the manual reference marker method. With this method, a fine-tip surgical marker is used to mark the 3 and 9 clock positions on the limbus while the patient is sitting and looking straight ahead. This takes into account the variable degree of cyclotorsion that occurs when patients assume the supine position for surgery.

Once the patient is positioned for surgery, the surgeon can use a corneal meridian marker to mark the desired target axis. Many modifications of this technique exist, including marking at the slit lamp or using toric markers with built-in bubbles, pendulum markers, or smartphone applications such as toriCAM, developed by Graham D. Barrett, MD.⁹ Another approach is to use preoperative imaging with intra-operative iris and limbal landmark registration to provide an image overlay of the toric axis in the surgeon's microscope.

Although image-guided¹⁰ and smartphone marking techniques⁹ have been shown to lead to slightly lower degrees of misalignment (Table 2), this has not correlated with better visual acuity results or lower residual astigmatism.¹⁰ Consequently, we recommend experimenting with different marking techniques until you find what works best for you and your practice.⁹⁻¹⁵

LENS IMPLANTATION AND ORIENTATION

Initial implantation of a toric IOL should be done in the same fashion the surgeon is accustomed to with a nontoric IOL. However, as the haptics are unfolding, we recommend positioning the IOL axis marks 5° to 10° counterclockwise from the final desired axis. This will compensate for lens shift during removal of OVD, during which the lens often rotates by several degrees independently. Once all of the OVD has been removed, the IOL can then be rotated clockwise into the final position using a blunt second instrument through the paracentesis incision.

Given the standard haptic configuration and angle of most IOLs, it is never recommended to rotate more than a few degrees counterclockwise, as this can put unwanted stress on the capsular bag and increase the risk of a capsular tear. We also recommend aspirating the OVD from behind the toric IOL in order to minimize the risk of rotation postoperatively, which can occur due to residual OVD between the IOL and capsular bag. Finally, caution should be used in high axial myopes, in

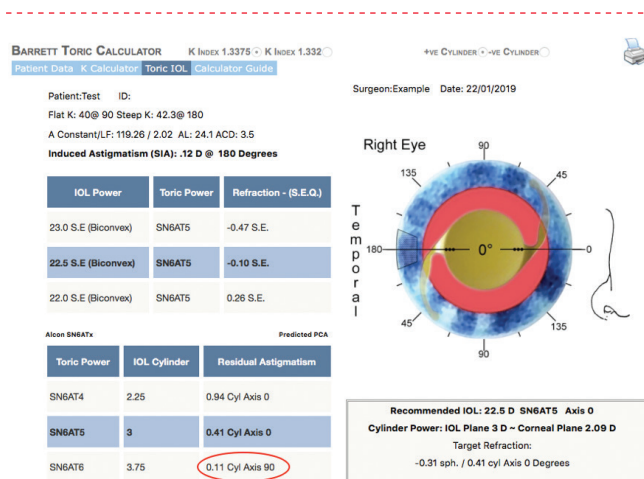


Figure. Measurement from ascrs.org/barrett-toric-calculator: The default lens selection is for a T5 toric, which would leave the patient with 0.41 D of ATR astigmatism at 0°. We would recommend instead using a T6 toric, which would minimize the residual astigmatism to 0.11 D and flip the axis to WTR.

TABLE 2. OVERVIEW OF STUDIES REPORTING MEAN ERROR IN TORIC IOL ALIGNMENT USING DIFFERENT METHODS

Study	Mean Misalignment (°)
Visser¹¹	
Bubble marker	4.9 ±2.1
Popp¹²	
Slit lamp	2.3 ±1.8
Pendulum	1.8 ±2.2
Bubble marker	2.9 ±1.9
Tonometer	4.7 ±2.9
Cha¹³	
Reference marker	3.7 ±1.5
Slit lamp	3.1 ±1.6
Mapping method	2.3 ±1.1
Carey¹⁴	
Slit lamp	2.6 ±2.8
Corneal analyzer	2.7 ±2.0
Montes de Oca¹⁵	
Reference marker	2.9 ±2.2
3D imaging	3.0 ±2.5
Webers¹⁰	
Reference marker	2.8 ±1.8
Image-guided system	1.3 ±1.6
Pallas⁹	
Reference marker	3.6 ±2.5
Reference marker + toriCAM	1.2 ±1.4
Slit lamp	2.8 ±1.9
Slit lamp + toriCAM	1.4 ±1.3

Modified and reprinted from Webers VSC, Bauer NJC, Visser N, et al. Image-guided system versus manual marking for toric intraocular lens alignment in cataract surgery. *J Cataract Refract Surg.* 2017;43(6):781-788; with permission from Elsevier.

whom the risk of toric IOL rotation after implantation is greater.

PATIENT COUNSELING

As is the case with any premium surgery, patient counseling is paramount. The expectation for both the patient and surgeon should be to maximally reduce, but not necessarily eliminate, the patient’s astigmatism. Given the limited range of toric lens powers, imperfect keratometry measurements, and variability of the posterior cornea, even with the

best surgical technique it is impossible to completely eliminate every patient’s astigmatism. Always inform patients pre-operatively that, occasionally, a patient will require a second procedure to optimize the correction of astigmatism; this advance discussion can be extremely helpful when addressing an error during the postoperative period.

For patients with an unexpectedly large amount of residual astigmatism after toric IOL implantation, the website astigmatismfix.com can be of

tremendous help in determining the best course of action, be it rotating the IOL, exchanging the IOL, or performing laser vision correction.

CONCLUSION

The best way to get started with toric lenses is by implanting monofocal toric IOLs in patients with low amounts of regular astigmatism, using the Barrett Toric Calculator, performing reliable axis marking and engaging in adequate and proper patient counseling. ■

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